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Two-Tiered Summer Bridge Programming for At-Risk Engineering and Computer Science Students

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In this paper, we report on the summer bridge programs offered by University of Portland to support “at-risk” freshman and sophomore engineering students. We define “at-risk” students as first and second-year students in good academic standing (i.e., not on academic probation) who are behind in their degree progress, either because they were not calculus ready when they started college, or because they did not earn a sufficient grade in one or more courses during their first two years in college. Each program targets students at a different point in their education: incoming freshmen and rising sophomores. We developed these bridges in conjunction with a grant-funded retention program and they have evolved based on quantitative and qualitative assessment data. By implementing these interventions, we hope to address the two major leaks in our retention pipeline: between the first and third semester and between the third and fifth semester, so that students graduate within a four-year timeframe that aligns with their financial aid.

Introduction

The University of Portland is a small, private university with about 3,700 undergraduate students, 700 of whom are in the Shiley School of Engineering. 97.5% of University of Portland undergraduate students receive financial aid, but students are only guaranteed eight semesters of financial aid. As a result, our engineering degrees are designed as four-year degrees and it is important for students to graduate within that time frame.

In 2013, we were awarded a National Science Foundation Graduate 10K+ Science, Technology, Engineering, and Mathematics Talent Expansion Program grant to assist with increasing the retention of at-risk engineering students. With the grant, we implemented the STEP retention program at University of Portland, as a response to low retention rates for “at-risk” first and second-year students within engineering (most students who leave engineering pursue one of the other majors on campus). For engineering, our most recent 10-year average 1st to 3rd semester retention rate is 78%, while the average 3rd-5th semester retention rate is 86%, and the average four-year graduation rate is 47%.¹ However, retention rates within engineering for “at-risk” students are significantly below these averages: students who start their degrees in pre-calculus have an average 1st – 3rd semester retention rate of 54%, an average 3rd – 5th semester retention rate of 65%, and an average four-year graduation rate of 25%. Note that so far, the “at-risk” population in the School of Engineering at UP demonstrates high academic performance, so it is not necessarily their engineering aptitude that is leading to poor retention.

The STEP retention program initially included a pre-freshman summer bridge program, a year-long advising program for freshman and sophomore students, and a peer-tutoring program for sophomore-level engineering courses. At-risk freshmen and

¹ We typically report a 5-year graduation rate since we have a sizeable population of ROTC students who graduate five years from when they entered the University.

sophomores who participated in the year-long advising program were also offered a scholarship that could be used towards a summer course to help them catch up with their cohort. Since its implementation, we made several changes to the STEP retention program that arose from both quantitative and qualitative assessments completed for each component. The primary innovation has been implementing a summer bridge for engineering students between the freshman and sophomore years. Lessons learned from these summer programs are the topic of this paper.

The overall STEP retention program is designed to increase the graduation rates of our “at-risk” engineering students by helping them develop the skills and confidence necessary to succeed while getting caught up academically with their cohort as quickly as possible. The entire STEP program is rooted in Tinto’s model of retention (1), which theorizes that students need to be engaged both socially and academically to be retained. The program also draws from research that shows career exploration as a factor in the retention of underrepresented students (2). Although the program is not specifically targeted at any particular demographic, many of the students eligible for the program are students of color (50% of all eligible students in 2013 and 2014 identified as non-white or more than one race²). Therefore, we also see the program as valuable for diversification of the engineering field.

Approach

In Summer 2014, we ran the first iteration of the pre-freshman summer bridge program. The 2014 summer bridge was a six-week program for incoming freshman engineering students who were not calculus ready (as determined by a math placement test that all students take before entering the School of Engineering). During the bridge program, students stayed in a residence hall together and took two courses: Pre-Calculus II and Introduction to Theology. Students who passed both courses were able to start their first year on-track in math and one course ahead in their overall degree plan; i.e., they were no longer “at-risk”. Outside of the courses, students attended presentations by various student support offices on campus, participated in academic workshops, and went on site visits to local engineering companies. The entire cost of the program, including housing and tuition, was paid for by the grant, meaning there was no cost to students outside of food, books, and travel. The first iteration of the pre-freshman summer bridge program was modeled after similar summer programs at Lafayette College, Oregon State University, and University of Southern California.

Of the 45 eligible students in 2014, nine participated in the bridge, although we had funding for more students. While assessment data collected before and after the program indicated that the pre-freshman summer bridge was successful in helping students transition to college and start the fall semester on track with their cohort, a few challenges emerged, including low student interest (particularly from students outside the Pacific Northwest) due to summer vacations, late high school graduation dates, and the cost for travel.

As a result of these logistical challenges, we changed the program for summer 2015. The most significant change was to design the bridge for “at-risk” rising sophomores

² The URM percentage for UP engineering students was 34% in 2013 and 36% in 2014.

who do not have the same logistical problems associated with incoming freshmen. These students also have a better understanding of the course plan for their major and the importance of staying on track with key foundational courses. In addition, students are only eligible for this program, known as Summer Scholars, if they participate in the STEP year-long program, which creates an incentive for student involvement. Although we originally had 14 students interested in participating in the 2015 Summer Scholars program, three students became academically ineligible because they were not on track to pass Calculus I in the spring semester prior to the bridge, and one student elected not to participate.

The sophomore bridge model is relatively similar to more traditional pre-freshman bridge programs: students live on campus and take two courses (Calculus II and a communications course), helping them catch up with their cohort in their math sequence. Students also participate in co-curricular activities that are designed to advance their professional and academic development in engineering, including site visits, job shadows, workshops (on resume and cover letter writing), and social events. We expanded the program to eight weeks to accommodate the Calculus II content. The bridge takes place almost immediately after the spring semester ends to make it easier for students to participate. Like with the pre-freshman summer bridge, the cost of housing, tuition, and field trips are covered by the grant. Although the travel logistics were solved because the program began right after the end of spring semester, only 10 of the 45 at-risk students ultimately participated.

In place of the pre-freshman summer bridge, we used a different intervention for incoming students in 2015: the STEP UP program, a two-day pre-orientation program for students who did not pass the math placement test. Interested students were required to complete an online pre-calculus course (selected by our math department). Students then came to campus two days before freshman orientation to attend academic workshops and social events - a campus treasure hunt, a workshop on time management and study strategies, and a faculty-student mixer, and retake the math placement test. Students who again did not pass the math placement test were encouraged to participate in the 2015-16 STEP year-long program. We designed the 2015 condensed pre-freshman program to address two challenges with the 2014 pre-freshman program: 1) because STEP UP is short and takes place just before orientation, it was easier logistically for students to attend (18 out of 53 eligible students participated in 2015, a much higher percentage than in 2014), and 2) the program is self-funded and relatively low in cost to the student (\$150 fee per person for meals and housing).

Program Goals

Besides the overall goals for our STEP program, each summer program also has a specific set of goals. One of the main goals of the pre-freshman programs is to help incoming freshman students start their first year on track with their cohort in terms of math. In addition, the pre-freshman bridges are largely focused on helping students get acquainted with campus and build community with one another, as well as increase their awareness of the STEP year-long program. The primary goal of the pre-sophomore bridge is to get rising sophomore students back on track in their math

sequence after they started (or fell) behind their cohort. In addition, the sophomore bridge is designed to focus more on students' professional development, including resume writing, networking, and career exploration.

Outcomes

As previously stated, while the 2014 pre-freshman bridge was successful in terms of addressing math deficiencies and the transition from high school to college, the travel logistics reduced the number of students who participated and thus limited its impact. On the other hand, while the modified two-day pre-freshman intervention with online pre-calculus had higher participation, none of the students passed the math placement test. Although math placement was the primary reason for this pre-freshman intervention, the condensed summer program proved valuable in increasing freshman participation in the 2015-16 year-long program: 78% of students in STEP UP participated in the year-long program in Fall 2015 compared to 31% of non STEP-UP participants. Based on qualitative assessments conducted at the end of the program, students in both versions of the pre-freshman programs benefited from learning about first year expectations, meeting other students, and understanding how starting in Pre-Calculus II affects their four-year plan.

Until this point, results from the sophomore summer bridge program show that 10 of the 10 participants passed both summer courses they took with a C or better, 9 have been retained in engineering as of mid-spring freshman year, and all 9 are on track for a four-year graduation. This compares with 7 of the 9 participants in the original 2014 pre-freshman summer bridge program who remain in engineering, with 4 on track for a four-year graduation at mid-spring of their sophomore year. Qualitative assessments conducted at the end of the pre-sophomore bridge program show students valued building an academic community with one another, and participating in various professional development opportunities (particularly site visits and job shadows). Students also mentioned feeling more confident with their math skills going into sophomore year. The table below shows retention data for the summer bridge components of the STEP program. Note that the spring 2015 data is unofficial; the cutoff date for enrollment is mid-January.

Retention Data – Summer Bridge Programs

	2014 Summer Bridge (Pre-Frosh)		2015 Summer Scholars (Rising Sophomores)		2015 STEP UP Program (Pre-Frosh)	
	<i>Participants</i>	<i>Non-Participants</i>	<i>Participants</i>	<i>Non-Participants</i>	<i>Participants</i>	<i>Non-Participants</i>
Number	9	36	10	37	18	35
1 st -3 rd Semester Retention	78%	81%	N/A	N/A	83%**	86%**
3 rd -5 th Semester Retention	100%*	83%*	90%*	78%*	N/A	N/A

* 3rd – 4th semester retention rate since only data thru mid-Spring 2016 semester

** 1st semester retention rate since only data thru mid-Spring 2016 semester

Future Plans

The initial outcomes for the summer bridge programs (and the overall STEP program) are promising in terms of improving retention.³ Based on our experience with the three versions of the summer bridges that we tried, these are the other lessons learned:

- Using our definition, the “at-risk” cohort is comprised of on average, high performing students with approximately 50% of the cohort self-reporting as underrepresented minorities.
- Travel logistics affect participation in summer bridge programs for pre-freshmen. Focusing on the summer between freshman and sophomore years may be better though there also needs to be a way to encourage these “at-risk” students to participate in the academic-year program during freshman year that addresses important academic and social aspects that influence retention.
- Summer bridges that include for-credit courses are expensive. The real cost per student for our programs are approximately \$8,000 not including travel costs and meals. However, on-line courses may not work best with this student population particularly during the summer between high school and freshman year.
- There needs to be a “hook” to get eligible students to participate in voluntary programs. This is true for the summer bridges as well as the academic-year long program. Even with a “hook” such as the ability to retake the math placement test, or the opportunity to catch-up with their cohort, many students decline to participate. [It has been difficult to get feedback from the non-participants.] Once students participate in a positive event associated with the program, they tend to continue participating.
- Besides the academic component, students value the professional development included with these programs including meeting practitioners.

Based on these lessons learned, we plan to move from a voluntary academic-year program to a mandatory program that is centered on a one-credit course in either the fall or spring semester of the freshman year. This will serve two purposes: a) all “at-risk” students will be involved with the year-long retention program for at least one semester that focuses on skills needed for academic success along with professional development and social issues (ideally this will be a positive experience that leads to continued involvement), and b) a larger number of “at-risk” students should be eligible for the sophomore bridge program to help them catch-up with their cohort. Placing the summer bridge that allows students to catch up academically with their cohort after the freshman year should be very effective if we can increase the number of eligible students via the one-credit course.

Broader Impacts

Although our retention program has so far only been offered to engineering students at University of Portland, the lessons learned may serve as a model for other STEM students both at University of Portland and at other similar private universities where a

³ It is too early to tell if there will be an impact to four-year graduation rates.

four-year graduation plan is critical. In addition, this project provides another way to define “at-risk students” that may help to focus retention efforts at other campuses.

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